U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—Bulletin No. 69.

D. E. SALMON, D. V. M., Chief of Bureau.



# THE EXTERNAL PARASITES OF HOGS,

BEING ARTICLES ON

## THE HOG LOUSE *(Hæmatopinus suis)*

AND

## MANGE, OR SCABIES, OF HOGS.

BY

EARLE C. STEVENSON, B. Sc., A. M.,
*Zoological Laboratory, Bureau of Animal Industry.*

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# LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
*Washington, D. C., January 28, 1905.*

SIR: I have the honor to submit herewith a paper entitled "The External Parasites of Hogs," by Earle C. Stevenson, of the Zoological Laboratory of this Bureau, and to recommend its publication as a bulletin.

This paper deals with two enemies of the hog—the hog louse, and mange, or scabies, of the hog. The first of these enemies especially, the hog louse, is one with which every hog raiser is familiar, and one that he has been forced to tolerate because he knew of no satisfactory cheap method of getting rid of the lice. This paper is designed, not only to give a technical description of the hog louse and the scab mite, but to give advice as to how to get rid of the lice and the mites and practical suggestions growing out of actual experience.

Respectfully,

D. E. SALMON,
*Chief of Bureau.*

Hon. JAMES WILSON,
*Secretary.*

# CONTENTS.

# ILLUSTRATIONS.

# THE EXTERNAL PARASITES OF HOGS.

By Earle C. Stevenson, B. Sc., A. M.,
*Zoological Laboratory, Bureau of Animal Industry.*

## INTRODUCTION.

In most of the published works on hogs and the prevention and treatment of their diseases the subject of external parasites is disposed of within the brief space of one or two pages, and the very short notes given on the prevention and destruction of these pests are no doubt due to the tendency to underestimate the economic importance of these parasites, for the reason that the injurious effects they produce are not always recognized as being of parasitic origin. The poor condition of health and stunted growth of some droves of hogs in a locality where other herds thrive on practically the same food and care is very frequently observed, particularly among young animals. This unhealthy condition may result from various causes. Observation and experiment, however, have demonstrated that not infrequently the trouble is to be traced to the presence of parasites on the skin of the animals. These parasites produce a diseased condition of the skin, annoy and irritate the hogs, and, in spite of excellent care and good food provided for them, interfere with the general health and growth of the animals. The injurious effects have been known to become so severe as to cause death to young pigs.

The three principal external parasites of the hog are the large louse (*Hæmatopinus suis*), the small itch mite (*Sarcoptes scabiei* var. *suis*), and the minute mite of follicular mange (*Demodex folliculorum* var. *suis*). Other external parasites have been noted by Jarvis (1904), who found in the Umtali District, South Africa, a number of ticks on hogs that were suffering from a disease known as "porcine malaria." This disease is said to be most prevalent during the rainy season, when ticks are most abundant. These ticks were determined as *Amblyomma varigata* (misprint for *variegata*), *A. flava*, *Rhipicephalus appendiculatus* (misprint for *appendiculatus*), and *Rhipicephalus* sp.?

*Demodex folliculorum* is of common occurrence, but seems to be of little economic importance to the farmer. It is found buried deep in the follicles of the skin and does not yield to ordinary treatment. *Hæmatopinus suis* is the largest representative of its family, and it

forms the principal subject of this discussion. *Sarcoptes scabiei* var. *suis* not infrequently becomes more injurious than the hog louse and therefore is of considerable economic importance.

The scope of this article includes a review of the literature on the subjects of lice and mange of hogs, a record of the new experiments performed, and a more complete account of the large louse (*Hæmatopinus suis*). (For Bibliography, see p. 35.)

## THE HOG LOUSE.

(*Hæmatopinus suis* (*Linnæus, 1758*) *Leach, 1817.*)

### BRIEF HISTORICAL REVIEW.

Mouffettus (1634, p. 265) mentions the hog louse and refers to Albertus (twelfth century) as having named it *Pediculus urius*, from the Latin word "urendo," meaning "to irritate." This early historical reference places the hog louse among the oldest recognized species of parasitic insects. Linnæus (1758) described it under the name *Pediculus suis.* Panzer (1798) used the name given by Linnæus, and states that Fabricius classed this parasite with *Pediculus asini* of Redi (1671). This reference to Fabricius, cited by Panzer, is not at hand, but in a later publication (1805) Fabricius gives the synonymy corresponding to the statement of Panzer. A comparison of Redi's figure of *Pediculus asini* with a specimen of *Hæmatopinus suis* shows a striking resemblance between the two, but Linnæus based in part his species *Pediculus asini* on Redi's figure and Panzer disregarded the classification of Fabricius. Leach (1817) subdivided the genus *Pediculus* into four genera—*Phthirus*, *Hæmatopinus*, *Pediculus*, and *Nirmus*—classing the hog louse as type of the new genus *Hæmatopinus.* Nitzsch (1818) revived the specific name *urius*, combining it with the generic name *Pediculus.* Giebel (1874), in describing the parasite, named it *Hæmatopinus urius.*

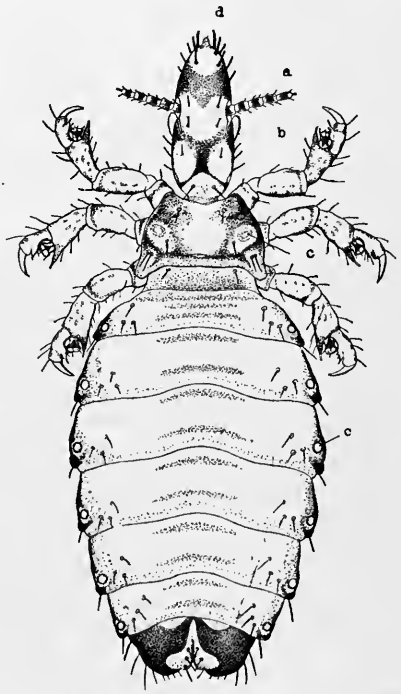


FIG. 1.—Dorsal view of female hog louse. × 15. *a*, antennæ; *b*, eye; *c*, spiracles; *d*, proboscis or haustellum.

## SYNONYMY.

The historical account given above shows the correct name of the hog louse, according to the rule of priority, to be *Hæmatopinus suis*. It has, however, received various designations as is shown by the following synonymy, which includes the different names under which this parasite has been known, together with the authors and their dates:

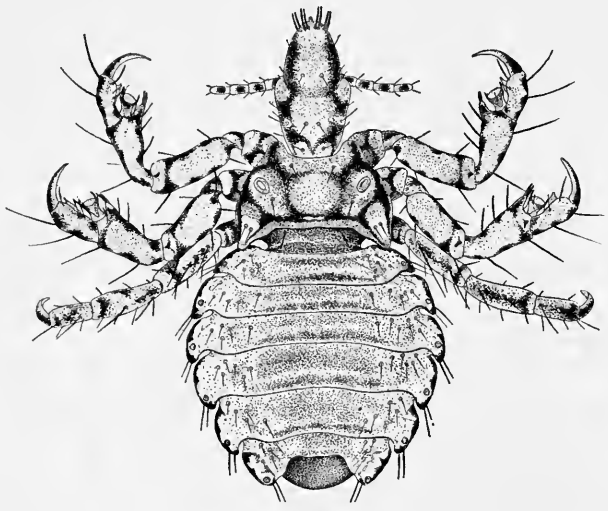

FIG. 2.—Dorsal view of male hog louse. × 15.

1758: *Pediculus suis* LINNÆUS, 1758, p. 611; 1798, v. 3, p. 18.—MUELLER, 1764, p. 90; 1776, p. 184.—CUVIER, 1817, p. 165.—PANZER.—[1798], pl. 16, FABRICIUS, 1805a, p. 342.—DE OLFERS, 1816, p. 86. [As synonym of *Hæmatopinus suis* in LEACH, 1817, p. 66.—SAMOUELLE, 1819, p. 143; 1824, p. 143.—STEPHENS, 1829, p. 329.—DENNY, 1842, p. 34; 1852, p. 4.—WALCKENAER, 1844, p. 306.—CUVIER, 1851, p. 489; [?] (Les Insectes), p. 74.—RAILLIET, 1895, p. 831.] [As synonym of *Pediculus urius* in NITZSCH, 1818, p. 305.—BURMEISTER, 1838, p. [13]; 1847, p. 577.] [As synonym of *Hæmatopinus urius* in GIEBEL, 1874, p. 45.—PIAGET, 1880, p. 654.—TASCHENBERG, 1880, pp. 103, 105, 106.—ZÜRN, 1882, p. 65.—PICAGLIA, 1885, p. 146.—OSBORN, 1891, p. 19; 1892, p. 205, pl. 1, fig. 5.]

1817: *Hæmatopinus suis* (LINNÆUS, 1758) LEACH, 1817, p. 65, 66, pl. 46 [first use of name was in Encycl. Brit., Suppl. 1, p. 24, ? 1810].—SAMOUELLE, 1819, p. 143; 1824, p. 143.—STEPHENS, 1829, p. 329.—DENNY, 1842a, p. 7, 34, pl. 25, fig. 2; 1852, p. 4.—GURLT, 1843, p. 12, pl. 1, fig. 11; 1857, p. 281–309; 1878, p. 165.—GRUBE, 1854, p. 242.—GERVAIS & VAN BENEDEN, 1859a, p. 382, fig. 81.—GERSTÆCKER, 1863, p. 307.—VERRILL, 1870, p. 112; [1871], p. 41, fig. 39.—PACKARD, 1873, p. 102, fig. 120.—HURTREL, 1875, p. 286, fig. 962.—MURRAY [1877], p. 386.—LAW, 1877, p. 284, 285, fig. 1.—COBBOLD, 1879, p. 414.—LANESSAN, 1882, p. 525.—WEST, 1882, p. 148, pl. 15, figs. 1–4.—LINTNER, 1882, p. 48.—PERRONCITO, 1882, p. 486, fig. 209; 1886, p. 333; 1901, p. 599.—GRIFFITH & HENFRY, 1883, p. 369, pl. 35, fig. 4.—UHLER, 1884, p. 294.—RAILLIET, 1886, p. 586; 1895, p. 831, fig. 570.—BROCCHI, 1886, p. 837, fig. 532.—FRIEDBERGER & FROEHNER, 1886, p. 632; 1895, p. 90.—POWER & SEDGWICK, 1886, p. —.—LUDWIG, 1886, p. 480.—COMSTOCK, 1888, p. 132, fig. 118.—

Gillette, 1889, p. 286, fig. 26; 1890, p. 47, figs. a–d.—Siedamgrotzky, 1889, p. 296.—Blanchard, 1890, v. 2, p. 436, fig. 675.—Brandt, 1890, p. 96, fig. 79.—Osborn, 1891b, p. 191.—Bos, 1891, p. 659.—Brown, 1895, p. 60, fig. 35.—Blanchon, 1899, p. 249.—Galli-Valerio, 1901, p. 349.—Guenaux, 1904, p. 454, fig. 299. [As synonym of *Hæmatopinus urius* in Giebel, 1874, p. 45.—Piaget, 1880, p. 645.—Zürn, 1882, p. 65.—Picaglia, 1885, p. 147.—Neumann, 1888, p. 64, figs. 23, 30; 1892, p. 72, 73, figs. 25, 26.—Galli-Valerio, 1896, p. iii.] [As synonym of *Pediculus suis* Linn. in Walckenaer, 1844, p. 306.] [As synonym of *Hæmatopinus irritans* in Law, 1903, p. 13.]

1818: *Pediculus urius* Nitzsch, 1818, p. 305; 1852, p. 130.—Burmeister, 1838, p. [13], pl. [1] Phthirius, fig. 4, pl. [2] Pediculus, figs. 9, 10, 13, 14; 1847, p. 577–578, pl. 1. figs. 1–10.—Schiodte, 1864, p. 50; 1866, p. 215. [As synonym of *Hæmatopinus urius* in Giebel, 1874, p. 45.—Piaget, 1880, p. 654.—Picaglia, 1885, p. 146.] [As synonym of *Hæmatopinus suis* in Stephens, 1829, p. 329.—Denny, 1842, p. 34; 1852, p. 4.—Railliet, 1895, p. 831.] [As synonym of *Pediculus suis* in Walckenaer, 1844, p. 396.]

1866: *Hamatopinus suis* L. Goureau, 1866, p. 205. [Misprint.]

1874: *Hæmatopinus urius* (Nitzsch, 1818) Giebel, 1874, p. 45, pl. 2, fig. 6.—Gurlt, 1878, p. 165.—Piaget, 1880, p. 654, pl. 53, fig. 4.—Taschenberg, 1880, p. 103, 105, 106.—Zürn, 1882, p. 65.—Neumann, 1888, p. 64, figs. 23, 30; 1892, p. 72, 73, fig. 36—Osborn, 1891, p. 18, 20, fig. 8; 1892a, p. 338, pl. 1, fig. 5; 1892b, p. 204; 1896, p. 178, 179, fig. 102.—Francis, 1894, p. 452.—Lugger, 1896, p. 129, fig. 70.—Galli-Valerio, 1896, p. 110.—McCarthy, 1896, p. 134, fig. 24.—Smith, 1900, p. 80.—Niles, 1900, p. 66, 67, fig. 26.—Lewis, 1902, p. 14, fig. 6.—Peters, 1902, p. 21, fig. 7.—Theobald, 1904, p. 22.—Craig, 1904, p. 947, fig. 2. [As synonym of *Hæmatopinus suis* in Railliet, 1886, p. 586.—Brandt, 1890, p. 96, fig. 79. As synonym of *Hæmatopinus irritans* in Law, 1903, p. 13.]

1886: *Hematopinus suis* (Linnæus, 1758) Delafond & Bourguignon, 1862, p. 561.—Mégnin, 1886, p. 77, 78; 1895, p. 77, 78. [Misprint.]

1890: *Haematopius urius* (Nitzsch, 1818) Harz, 1890, p. 486. [Misprint.]

1896: *Haemotopinus suis*, Schneidemühl, 1896, p. 346. [Misprint.]

1896: *Haemotopinos urius*, Schneidemühl, 1896, p. 346. [Misprint.]

1896: *Pedikulus suis*, Schneidemühl, 1896 [as synonym of *Hæmotopinos urius* in Schneidemühl, 1896, p. 346.] [Misprint.]

1900: *Hæmatopinus urinus* (Nitzsch, 1818) Niles, 1900, p. 67. [Misprint.]

1900: *Hæmatopium urius*, Stevens, 1900, p. 28. [Misprint.]

1903: *Hæmatopinus irritans*, Law, 1903, p. 13.

1904: *Hæmatopinus uris*, Craig & Bitting, 1904, p. 169. [Misprint.]

(?): *Ricinus* (*Hæmatopinus*) *suis*, Leach in Cuvier [Insectes], pl. 14, fig. 3.

## CLASSIFICATION.

*Hæmatopinus suis* is one of the wingless Arthropoda formerly classed by Osborn (1896) in the family Pediculidæ of the suborder Parasita, under the order Hemiptera of the class Hexapoda, or six-footed insects. On the basis of an embryological study of the Pediculidæ, Kholodkovsky (1903) arrived at the conclusion that they should be classed under a separate order, for which he proposed the name Pseudorhynchota.

Enderlein (1904), in his recent revision of the classification of the Pediculidæ, established the new family Hæmatopinidæ, with a

subfamily Hæmatopininæ, which includes the genus Hæmatopinus, with *Pediculus suis* Linn. (=*Hæmatopinus suis* Leach), as type. Enderlein classes the family Hæmatopinidæ in the suborder Anoplura Leach (1817) under the order Rhynchota, and makes Siphunculata Meinert (1891), Pseudorhynchota Kholodkovsky (1903), and Lipognatha Börner (1904) synonymous with Anoplura.

## GEOGRAPHICAL DISTRIBUTION.

This parasite lives on both domesticated and wild hogs of any age and condition. The numerous references in literature to the hog louse and reports of its occurrence in different countries show that this parasite exists wherever the hog is found. Denny (1842) writes of its common occurrence in Ireland but comparative rarity in England. It is common on hogs everywhere in the United States. Stockmen handling hogs often become temporary hosts of the louse, but it has never been known to remain for any length of time on the human body, and is not known to exist on any animal other than the hog. Attempts made at this laboratory to propagate *Hæmatopinus suis* on dogs have met with repeated failure.

FIG. 3.—Ventral view of last three abdominal segments of male louse. × 12.

## DESCRIPTION.

The hog louse is the largest representative of its family, and, as the generic name indicates, is a blood-sucking parasite. The female attains a length of 6 mm. (one-fourth inch). The male is smaller than the female and is readily distinguished by the dark streak along the ventral median line of the last three abdominal segments (fig. 3). The division of the body into head, thorax, and abdomen is distinct.

Head: The head is narrow, elongated, and rounded at the anterior end. The conical, unjointed haustellum, or proboscis, is very prominent, and about the middle of the lateral margins of the head are situated the slender, filiform, five-jointed antennæ, one on each side. Each joint of the antennæ has a dark brownish ring about its middle, the distal joint often being entirely fuscous, and bears on its extremity a tuft of hairs, or bristles. The eyes are flat and of a pale bluish color; they are located posterior and dorsal of the base of the antennæ and are very conspicuous.

Mouth parts: The mouth parts are of particular importance in the present connection as it is due to their action that the irritation and inflammation of the skin, occurring in infested hogs is produced. They are also of interest in view of the possibility that certain diseases, such as hog cholera, may be transmitted by the hog louse.

Burmeister (1847) states that the protrusible haustellum bears a double crown of hooks, with 10 or 12 hooks in each row, and that the sucking tube, or stylet, is formed of an inner and an outer tube, each made up of symmetrical halves. Erichson (1839), Simon (1851), and Landois (1864) each describes mandibles in Pediculidæ. Schiodte (1864) states that the "haustellum" described by Burmeister represents the labium, which may be retracted into the head, and that the supposed mandibles seen by Erichson, Simon, and Landois are parts of the labium. Brühl (1871) states that the stylet is formed of dorsal and ventral halves, which are protruded separately and afterwards brought together to form a tube. Gerstfeldt (1853) states that the stylet is formed of two chitinous half cylinders united, and includes two setæ likewise united. Packard (1888) says the Pediculina have a

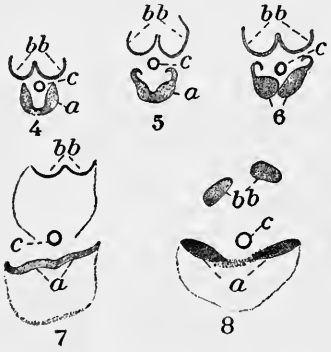


FIG. 4.—Cross section of anterior part of stylet or so-called sucking tube. *a*, ventral part; *bb*, dorsal part; *c*, capillary tube.

FIGS. 5–6.—Cross sections of intermediate portion of the stylet.

FIGS. 7–8.—Cross sections of posterior or basal part of stylet. Fig. 8 shows diverging roots of the stylet. (Magnified 850 times.)


FIG. 9.—Posterior part of capillary tube and ventral part of stylet showing the basal branches or roots.


FIG. 10.—Posterior portion of dorsal part of stylet showing the basal branches or roots.

beak-like sucker which is soft and retractile, with two protrusible chitinous bristles. Kholodkovsky (1903) states that the stylet does not function as a sucking tube, but is merely a piercing organ used to produce a wound and does not convey the blood into the mouth. Enderlein (1904) states that the stylet is formed of two ventral parts (lobi internus and hypopharynx) united to form a tube and a dorsal part consisting of two chitinous bands.

A cross section of the stylet (figs. 4 to 8) shows that it is formed of three chitinous parts—a ventral half cylinder (*a*), within the concavity of which lies a minute capillary tube (*c*), 2 $\mu$ in diameter, and a dorsal part (*bb*), which is formed of two half cylinders lying side by side and fused together. Each half of the dorsal part is bilobed at its distal extremity (fig. 12).

If a louse is placed on the hand and allowed to thrust its stylet into the skin, a sharp stinging sensation is felt. Soon blood will be seen in a pulsating ventricle in the head of the louse. If the head is now cut off just back of the antennæ, and carefully pulled loose from the hand, the proboscis is seen to be everted, with the hooks on its outer surface directed backward, and the stylet, still protruding, is covered with blood stain. This indicates that the stylet is not withdrawn after making a wound, and that blood flows along the parts of the stylet into the mouth cavity, the flow being kept up by the pumping ventricle, which is a modified portion of the esophagus provided with muscle attachments for expanding its walls. The stylet is contained in a movable sheath (fig. 11) in a canal which lies ventral of the esophagus and opens into the mouth cavity. The 12 hooks (fig. 12) on the proboscis are located on its dorsal and lateral surface, none occurring on the ventral side. The hooks are drawn inside the proboscis when it is retracted.


FIG. 11.—Basal branches of stylet and the sheath containing the stylet. (After Burmeister, 1847, fig. 6.)

Measurements of the stylet from its base to its extremity give a length of 1⅓ to 1½ mm.

Figure 11, taken from Burmeister (1847), shows the posterior portion of the stylet with the sheath containing it. The parts *bb* and *c*, described by Burmeister as roots of the inner tube, constitute the origin of the two ventral parts of the stylet (fig. 9, *a*, *c*). The parts *aa*, described as roots of the outer tube of the stylet, form part of the origin of the dorsal part of the stylet (fig. 10). The parts *cc*, described as diverging branches of the sheath containing the stylet, are not only connected with the base of the sheath, but also help to form the origin of the dorsal part of the stylet (fig. 10). Figure 12 is a greatly enlarged dorsal view of the proboscis protruded, showing the 12 hooks everted, also the parts of the stylet. When the stylet is normally protruded its parts are closely approximated and can not be distinguished, except in instances where the dorsal part *bb* is partially retracted and the ventral parts remain protruded.

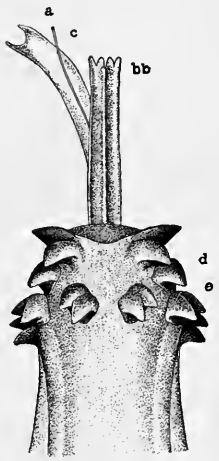


FIG. 12.—Dorsal view of everted proboscis. *a*, ventral part of stylet; *bb*, dorsal part of stylet; *c*, capillary tube of stylet; *d*, hook with single prong; *e*, hook with double prong. The parts of the stylet are separated to show their relations. (Magnified 440 times.)

Thorax: The thorax is broader than long; anterior dorsal margin concave; posterior dorsal margin slightly notched at the median line;

posterior lateral angles acute. On each side, near the anterior lateral margin is a spiracle opening on the dorsal surface. On the ventral surface between the appendages is a chitinous shield. In each anterior lateral angle of this shield or plate is an opening called the osteole, leading from a canal that extends cephalad.

Abdomen: The abdomen is divided into nine segments. The second to the seventh segments inclusive are bordered on each side with a horny excrescence surrounding a light-colored spiracula (fig. 1, *c*). The first and last segments are without spiracula, and the last segment has on the dorsal surface two dark-colored, chitinous plates joined anteriorly by a narrow strip of chitin. The color of the abdomen varies from ashy blue to nearly white.

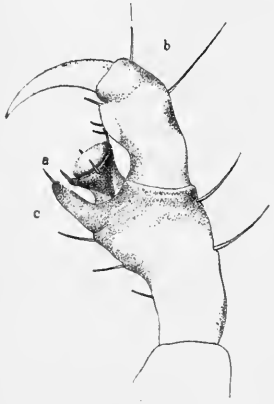


FIG. 13.—Claw of *Hæmatopinus suis*. *a*, pad in the end of tibia against which the hair is pressed by the tarsus; *b*, tarsus; *c*, tibial tooth.


FIG. 14.—Eggs of *Hæmatopinus suis* attached to a hair (magnified eight times). *a*, natural size of eggs.

Legs: The legs, attached on the ventral side of the thorax, are long and thick, pale yellow in color, with banded joints. The tarsus (fig. 13, *b*) is curved and jointed, enabling the claw to clasp the hair, pressing it against the tibial tooth and retractile disk, or pad, in the end of the tibia (fig. 13). The louse travels sideways and, with the aid of its claws for grasping the hairs, can move quite rapidly.

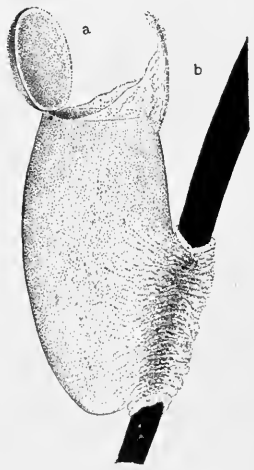


FIG. 15.—Shell of egg from which the young louse has escaped. *a*, operculum or lid; *b*, ruptured embryonic membrane. (Magnified 27 times.)

## EGG OF THE HOG LOUSE.

When a hog is badly affected with lice hundreds of eggs will be found on the hair back of the ears, along the front of the shoulders, and on the flanks. The freshly deposited egg is bluish white in color, elongated, oval in shape, 1.5 mm. long, and is enlarged at the end bearing the circular operculum, or lid, which is forced open when the

young louse is ready to hatch out. The egg is attached at its smaller end to the base of the hair by a gluey substance that usually completely encircles the hair (fig. 15). The surface of the egg is covered with small hexagonal punctations, which give it a honeycomb appearance. The shell of the egg is perforated by numerous stomata (figs. 16, 17).

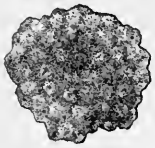

FIG. 16.—Outer surface of shell of egg showing the stomata. (Magnified.)

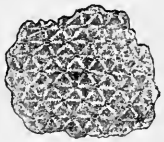

FIG. 17.—Inner surface of shell of egg showing the inner orifices of the stomata. (Magnified.)

Incubation: It is stated in Coburn's (1888) "Swine Husbandry" that the egg will hatch out in about five days after being deposited. Tests conducted at Washington, D. C., however, show that the time of incubation will vary with changes in temperature and moisture. It was found that eggs freshly deposited and kept in a room of ordinary humidity at a temperature of 85° F. during the month of September hatched out in from fifteen to sixteen days, while the eggs placed in a closed dish containing a receptacle filled with water hatched out in twelve days. Lowering the temperature retards development of the eggs.

## INJURIOUS EFFECTS OF THE HOG LOUSE.

It seems necessary to emphasize this part of the subject since usually little attention is given by farmers to this parasite. Every farmer and stock raiser is familiar with the frequency and wide distribution of the hog louse, but they do not always attribute to it any pathologic or economic importance. When a drove of hogs is not thriving properly the more common custom is to pronounce them out of condition, or simply off feed, and a patent stock food or a patent condition powder is administered, with no evident benefit. In such cases, if a careful examination of the animals is made, the cause of the unthrifty condition is often directly traceable to the presence on the skin of large numbers of lice or other external parasites.

When lice increase to large numbers, as they are likely to do if not destroyed, the skin of the animals becomes covered with scales and sores, and in extreme cases swelling and inflammation develop as a result of the parasites piercing the skin with their mouth parts hundreds of times each day in their effort to secure blood for food. The irritation thus produced is a source of constant annoyance and worry to the hogs, evidenced by their restlessness and incessant rubbing and scratching against any convenient object. The ultimate effect of such affliction is seriously to interfere with the growth and fattening of hogs, especially of young pigs.

Lice not only produce a direct injury to hogs by impairment of the skin, but also, by reason of the debilitated condition of the animals

which ensues, indirectly create a greater susceptibility to various diseases. It is stated by Peters (1902), of the Nebraska Experiment Station, that observations in his work show that during epidemics of hog cholera animals affected with lice are most susceptible to the disease, and that the percentage of fatalities is greater than among herds free from lice. So evident is this that the first treatment he recommends for hog cholera is to destroy the lice on the animals and disinfect the pens.

The opinion that the hog louse may carry the infection of hog cholera from sick to healthy animals is not without support among some writers on diseases of hogs. Dodge (1869, pp. 125–217) quotes abstracts from correspondents referring to worms and lice causing hog cholera. No positive evidence or experiments have been brought forward, however, and the possibility of the hog louse conveying diseases is an open question.

The destruction of this parasite is a comparatively easy matter, and practical tests have demonstrated the economic importance of freeing hogs from a pest that deters growth, weakens the general physical condition, and renders the animals an easy prey to contagious maladies.

## TREATMENT FOR THE HOG LOUSE.

### PREVENTIVE MEASURES.

Any treatment to prove effective against lice on hogs must include preventive measures as well as destructive remedies. The sleeping quarters of lousy hogs become infested with lice, which crawl off the hogs and secrete themselves in the crevices of the building and in the bedding, while the eggs on the hair that the hogs shed and rub off will hatch out young lice. These parasites in the building immediately reinfest animals from which the lice have been removed by treatment. The selling and slaughtering of the majority of hogs at a comparatively early age, and the consequent destruction of the lice on them in the scalding vat, is naturally a great check to the increase in the number of the parasites. As a usual thing, however, an entire herd of hogs is not sold at one time, and the few remaining animals will serve as hosts for the lice in the building until a new drove of hogs is placed in the same pens, when the lice at once begin to multiply rapidly on their new hosts. A thorough treatment, therefore, includes the destruction of the lice in the buildings and pens in addition to treatment of the animals themselves. If the pens where lousy hogs have been kept are left vacant for a period of two weeks all lice will have perished, and any new animals introduced will be in no danger of infection.

For disinfection of buildings Peters (1902) gives preference to a 3 per cent solution of any of the coal-tar preparations, to be applied with a broom or spray pump.

Niles (1900) recommends a 2 per cent solution of carbolic acid, solutions of benzine and kerosene (said not to be so effective as carbolic acid), and air-slaked lime having a little carbolic acid added and dusted over the floors.

Probably the most convenient method of combating lice and mites in buildings is the common custom of applying whitewash made by slaking lime with water (1½ pounds to 1 gallon of water). Popular usage has made this a standard remedy, for it has been found to be effective. Crude carbolic acid added to the whitewash (1 pint of the acid to 4 gallons of whitewash) is said to increase its effectiveness.

In treating hogs infected with lice special attention should be given to those parts of the body where the lice congregate in greatest numbers. They are found principally inside, behind, and in front of the ears, on the breasts, and back of the fore legs. Even with the most thorough treatment, however, some of the lice are apt to escape, and these, if not destroyed, soon increase in numbers. The eggs are not all destroyed by any single treatment. These facts make it necessary to repeat any treatment used in order entirely to eradicate these pests from a badly infested herd. When strange hogs are added to a herd they should always be examined for parasites in order that any infested ones may not cause the spread of lice throughout the entire herd.

### TREATMENT OF THE HOGS.

Many different preparations have been used to destroy lice on hogs. Probably the oldest method is the use of washes or liquid insecticides. It is frequently stated that a dust bath for hogs is destructive to lice, but T. J. Brewster (1894), of Kansas, declares that the lousiest hogs he ever saw were confined in extremely dusty pens; he recommends kerosene as an effective remedy.

The agricultural experiment stations have carried on numerous experiments in the treatment of the hog louse, and a brief review of the work is here given.

Gillette (1889) successfully used kerosene emulsion, which was sprayed over pigs by means of a force pump and spray nozzle. Thirty-seven hogs, weighing from 125 to 250 pounds, were treated with 6 gallons of emulsion, the cost of which (exclusive of labor) was but 13 cents. The animals were crowded into a close pen and thoroughly sprayed. The cheapness of this remedy allows it to be used freely and often, as is necessary with the usual treatments.

Lewis (1902) constructed a dipping vat and used proprietary dips. He states that his experiments proved the remedies to be useless in the weak solutions recommended by the manufacturers. Nothing less than a 2 per cent solution could be relied on to kill the lice.

A. E. Verrill (1870) reports as the best and simplest remedy a solu-

tion of sulphuret of potassium in water—from 2 to 4 ounces to 1 gallon of water. Apply the solution with a brush or spray.

Lugger (1896) recommends pyrethrum mixed with kerosene emulsion.

Tracy (1899) used successfully kerosene and water in a spraying pump (see p. 21) with an attachment for mixing the oil and water in the proportion of 5 parts of water to 1 of oil. He recommends spraying in the evening, in order that the oil may evaporate during the night, thus avoiding the danger of blistering the skin by action of the sun's heat on the oily skin.

The various stock journals of this country contain frequent notes from rural correspondents reporting success in the use of pure kerosene, applied to the animals by means of a spraying machine or with a brush or broom.

E. H. Kern (1904), a Kansas farmer, writes that he used pure kerosene oil applied with a knapsack sprayer (fig. 26). He states that, contrary to the expectations of his neighbors, the hair did not come off, neither did the skin blister, but on the morning following the application "thousands of dead lice were found among the loose scales of dirt and mange on the backs of the hogs." The animals immediately improved in looks and condition.

Craig & Bitting (1904) recommend pure kerosene oil as the cheapest remedy for lice on hogs. A sufficient amount of water is placed in the dipping vat and the oil then added to a depth of 1 inch. The hogs, when driven through the liquid, emerge with a thin coating of oil over the entire body.

It must be stated, however, that the application of pure kerosene to the skin of hogs has been known to produce blisters and cause the hair to fall out. The writer has observed these results follow such heroic treatment. When pure kerosene is applied, the caution to use it in the evening in order to avoid the effect of the sun's heat on the skin freshly wet with kerosene must be strictly observed, and care be taken not to apply the oil too freely.

The statement has been made (Knob, 1903) that kerosene used on pregnant sows will produce abortion, but the frequent use of kerosene on pregnant sows without evil results ensuing indicates that such accidents are unusual.

Oliver (1896) recommends 1 part of kerosene mixed with 2 parts of linseed or cotton-seed oil, applied once a week till the lice are all destroyed.

A decoction of stavesacre seed (*Delphinium staphysagria*), using 2 ounces of seed to 1 quart of water, is much used in England to kill lice. Vinegar added to the liquid is said to destroy the eggs of lice.

A decoction of equal parts of hellebore, sabadilla, and stavesacre has been recommended as effective against lice.

A herd of lousy hogs in the vicinity of Kensington, Md., was treated in separate lots with kerosene emulsion, several proprietary preparations, and an emulsion of Texas oil. These remedies were all tested at this laboratory by plunging lice into the various solutions and laying them aside to dry. Every preparation in dilute solution killed the lice in a few seconds, excepting the Texas oil, which was effective only in concentrated solution and acted more slowly.

The hogs were sprayed twice, two weeks intervening between the two treatments. Kerosene in a 10 per cent emulsion proved successful. Creolin in a 3 per cent solution also destroyed the lice. The Texas oil in a 10 per cent emulsion was found to be absolutely useless. The exact results of the tests with proprietary preparations could not be determined, for the pigs treated with them escaped from their pen after the first treatment and a few lice were found on some of the animals.

Later experiments with Texas oil in the crude state have demonstrated its value as a dip for hogs affected with lice and the itch mite (*Sarcoptes scabiei*). Fifty-two gallons of oil were placed in a tank with 60 gallons of water and the pigs dipped once. A few days after dipping the lice were found to have disappeared, and the scab mites, with which the animals were severely affected, were also destroyed.

The foregoing account of results of experiments with different remedies used against the hog louse shows that the following are successful, cheap, easily prepared, and readily applied: Kerosene emulsion, kerosene and water, kerosene (pure, but to be used with caution), Beaumont oil, and benzine emulsion (not much used). None of the arsenical or poisonous insecticides is mentioned, for, when nonpoisonous remedies are thoroughly efficient and readily obtained there is no necessity of running the risks attendant on the use of these poisons.

The lime-and-sulphur dip recommended as a cure for scabies in cattle and hogs was tried as a remedy for lice on hogs but has not as yet been sufficiently tested for a statement of results at this time.

### FORMULAS OF OIL EMULSIONS.

1. Kerosene emulsion is prepared according to the proportions in the following formulas:

(*a*) Hard soap, ½ pound (one-half bar common soap).
Kerosene, 2 gallons.
Water, 1 gallon.

Boil the water and soap until the latter is dissolved, remove from the fire, then add the kerosene and churn or agitate vigorously till an emulsion is formed. This emulsion, if thoroughly mixed, will form a gelatinous mass on cooling; it keeps indefinitely and may be used at any time by diluting with warm water to 20 gallons. If used after cooling, the mixture should be heated again (great care must be exercised in heating a second time because of the inflammable kerosene present, and for

safety the mixture should be heated out of doors) and then thoroughly mixed a second time.

(*b*) Soft soap, 1 quart.
Hard soap, ¼ pound.
Kerosene, 1 pint.
Water, 2 quarts.

Mix as in preceding formula and dilute with 1 gallon of warm water. Reheat as in formula (*a*)

(*c*) Sour milk, 4 gallons.
Kerosene, 2 gallons.
Mix the milk and kerosene and dilute with warm water to 20 gallons.

This formula has the advantage over other methods of making kerosene emulsion, as it avoids the necessity of making a soap mixture, the milk acting as an emulsifier.

(*d*) Hard soap, ½ pound.
Pyrethrum, 3½ pounds.
Kerosene, 2 gallons.
Water, 1 gallon.

Boil the water and soap until the latter is dissolved. Extract the pyrethrum with the kerosene by stirring the pyrethrum and kerosene together and allowing the mixture to stand for twenty-four hours, then pour off the liquid. The kerosene extract is then mixed with the soap solution as in formula (*a*). For use dilute with warm water to 20 gallons. Reheat as in formula (*a*).

The pyrethrum is said to add to the effectiveness of the emulsion.

The kerosene emulsions when prepared should not have oil drops rising to the surface. If drops of oil are seen it is proof that the emulsion has not been sufficiently churned or agitated to emulsify the mixture.

Goff (1891) describes and figures a spraying pump for mixing kerosene and water, which mixture is said to be more penetrative than an emulsion. This pump is fitted with a foot-valve admitting oil and water through separate orifices and a graduated screw regulating the proportionate amount of each fluid admitted. The packing and pistons should be made of leather and the valve seats of brass, on account of the destructive action of the liquid on fittings made of other materials.

2. Benzine emulsion:

Soft soap, 4 parts.
Water, 10 to 15 parts.
Benzine, 1 part.

Boil the water and soap until the latter is dissolved, remove from the fire, then add the benzine and agitate till an emulsion is formed.

## MANGE, OR SCABIES, OF HOGS.

### CAUSE OF MANGE.

Mange in hogs, which is a disease of the skin caused by parasitic mites, is of two kinds. The demodecic form is produced by a mite named *Demodex folliculorum* var. *suis* (=*D. phylloides* Csokor) (figs. 21, 22). The sarcoptic form, which is better known and considered to be more common than demodecic mange, is caused by a mite known as *Sarcoptes scabiei* var. *suis* (figs. 18, 19). These two parasites of mange in hogs are designated as "variety *suis*" in order to distinguish them from parasites of the same species which cause mange in the dog, the cat, the sheep, and some other animals. Many writers consider them distinct species, and a third mite, *Sarcoptes parvulus* Can., has been described from the hog.

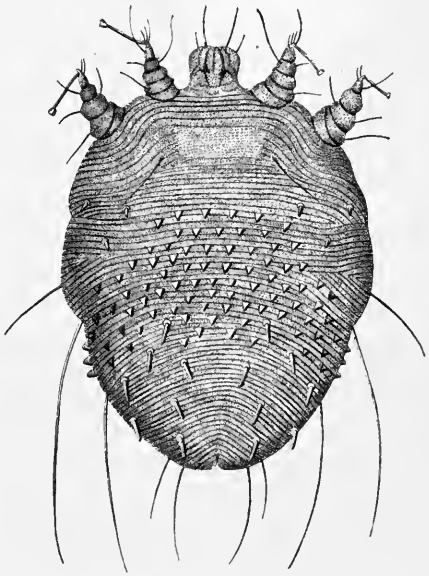

FIG. 18.—Dorsal view of female mite (*Sarcoptes scabiei* var. *suis*) causing sarcoptic mange. (After Gerlach 1857.) × 150.

### SARCOPTIC MANGE.

Neumann (1888) states that Viborg described this disease in the year 1805, but that Spinola first found the sarcopt causing it on wild hogs in the year 1846. Gerlach (1857) mentions its frequent occurrence on wild hogs near Berlin and on hogs in Holland. Müller (1864) and Kocourek (1865) both found the sarcopt on hogs in China. This parasite has been observed in England, France, Ireland, Denmark, Canada, Japan, and frequently in the United States.

The disease is described by the majority of writers on hog diseases, and numerous references to it are found in the veterinary journals and in periodicals devoted to the hog industry.

DESCRIPTION.

This parasite is the largest variety of its species and can readily be seen with the aid of a pocket lens. It is small, white, globular in shape, with the body transversely striated. In front is a prominent mobile rostrum. On the dorsal surface of the body are numerous three-cornered scales, also 6 thoracic and 14 abdominal spines.

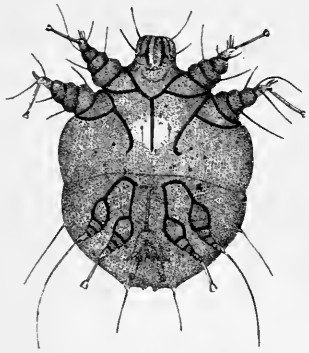

FIG. 19.—Dorsal view of male mite (*Sarcoptes scabiei* var. *suis*) of sarcoptic mange. (After Gerlach, 1857.) ×150.

The first and second pair of legs in the female bear a pedicellate sucker. The third and fourth pair end in a long spine. The first, second, and fourth pair of legs in the male bear a pedicellate sucker, while the third pair end in a long spine.

The female is nearly one-half millimeter long and about one-third millimeter broad. The male is a little smaller than the female. The egg is 0.17 mm. long and 0.12 mm. broad.

REPRODUCTION.

The eggs (fig. 20) are deposited by the female and hatch, according to different authorities, in three to eight days, under favorable conditions.

It has been estimated by Gerlach that a male and a female sarcopt will, after a period of three months, have a progeny of 1,500,000 descendants.

SYMPTOMS.

The skin is first inflamed and irritated about the eyes and ears; the pruritis gradually spreads over the withers, flanks, and inner surface of the thighs, later invading the entire surface of the body. The skin becomes wrinkled, is covered with crusts that take on a bluish gray luster, and the bristles either fall out or become matted with the crusts that are continually forming and dropping off. Beneath the crusts the skin is raw and cracked, the excoriation finally becoming so severe that bleeding occurs when the crusts are pulled off.

FIG. 20.—Egg of *Sarcoptes scabiei* var. *suis*. (After Gerlach, 1857.) ×150.

Conclusive diagnosis of sarcoptic or demodecic mange is obtained by finding the parasites. It is necessary to pull off the crusts and scrape the skin to the quick, and then examine the scrapings with a hand lens.

CONTAGION.

The disease is distributed only through contagion, either by diseased animals or by means of the buildings and pens where diseased hogs have been kept. It gradually spreads throughout a herd. An infested sow will transfer the disease in a severe form to her young before they are three weeks old.

Spinola (1863) states that scabies of the pig is not transferable to other animals. It has, however, been transmitted to the dog, and is said to be transmissible to the horse. Numerous instances are recorded of man contracting the disease through contact with mangy hogs.

### THE INJURIOUS EFFECTS OF MANGE.

Because of its destructiveness to the skin and the restlessness produced in the animals infested, sarcoptic mange is a most serious disease that increases in severity, and not only prevents proper growth and fattening of hogs, but will finally cause death to young pigs. It is, too, a more common disease than is generally believed.

### TREATMENT.

The instructions usually given for treating scabies, or mange, of hogs direct that the animals must be thoroughly cleaned by scrubbing them with soap and water or some strong alkali solution before a remedy is applied. Such care and detail are possible where only a few hogs are to be treated, but when herds numbering from 50 to 500 are to be treated such time-consuming and expensive operations are out of the question. Dipping the animals is the only practical method of applying remedies to large herds. Mange is at best a hard disease to combat, especially in hogs, because of their unclean habits and usually filthy quarters. When mange is discovered, the hogs should be shut away from mud wallows a day or so before treatment in order that the dirt and crusts may become rubbed off the skin.

It is not a difficult thing to control a hog in a properly constructed dipping vat, and an animal may be kept in the dip as long as desirable while the liquid is being rubbed into the skin with a brush or broom. Care must be taken to wet the inside of the ears thoroughly by rubbing them with the hands. If the hogs are simply driven through the dip without any scrubbing it will require a long time to eradicate the disease. After the hogs have been dipped they should be kept away from mud wallows and dusty pens for a day, in order that the dip may not be absorbed by dust and mud coming in contact with the wet skin. A time should be chosen for dipping when there has been no recent rain to make it possible for hogs to become covered with mud crusts. Never dip in cold weather. If only a few hogs in a herd show symptoms of scabies it is not sufficient to dip only those few that are badly infested, for other animals in the herd are sure to harbor some of the parasites, which will continue to spread the infection. A single dipping is not sufficient for a cure, for some of the parasites will escape destruction by the first dipping and more young mites will hatch from recently deposited eggs. A second dipping, therefore, should follow six days after the first treatment. The incubation period of the eggs under favorable conditions is stated to

be from three to five days. Perseverance is the only way to effect a permanent cure. The improved condition of scabby hogs, even on the day following a successful treatment, will be evident from their unusual quietness and better humor.

In addition to treating hogs for mange it is necessary either to remove the animals to new quarters for a period of four weeks, after which time the danger of reinfection in the old quarters is past, or to clean and wash the pens and buildings. (See p. 17 for washes for buildings.)

REMEDIES.

There are numerous mixtures and compounds that kill the scab mites, but the item of expense and the facility of preparation and application restrict a choice of remedies. Liquid remedies are the only practical ones to be used on a large scale; if ointments are used it is necessary to scrub the animals thoroughly before applying them.

*Ointments.*

(1) Helmerich's pomade (=sublimed sulphur 2 parts, potassium carbonate 1 part, lard 8 parts).

(2) Creosote 1 part, lard 25 parts.

(3) Sulphur 10 parts, lard 30 parts.

(4) Turpentine 8 parts, flowers of sulphur 1 part.

*Liquid preparations.*

(1) Lime-and-sulphur dip (=unslaked lime 10 pounds, flowers of sulphur 24 pounds, water 100 gallons).

Slake the lime with sufficient water to make a thin paste and stir in the sulphur. Boil this mixture with 25 or 30 gallons of water for two hours. Pour the liquid into a vessel and allow the sediment to settle. The liquid is then drawn off into the vat (carefully avoid disturbing the sediment) and warm water added to make 100 gallons. The proportions in this mixture must be exact. This preparation is used while warm.

Mr. J. J. Rosa, of Milford, Del., in a letter dated December 3, 1904, states that he used the above dip on 40 head of hogs affected with mange and reports a perfect cure after a second treatment.

(2) Potassium pentasulphide, 1 kilogram (2.2 pounds) dissolved in 30 liters (31.5 quarts) of water.

Scholl (1904) in a recent treatment of 160 hogs badly infested with mange washed them with soap and water, then applied the above solution. From the first day of treatment, it is reported, the irritation diminished; the skin lesions healed, and the animals rapidly put on flesh. A second treatment was given in two weeks as a precautionary measure.

(3) One part of creosote mixed with 30 parts of oil [linseed] is a remedy said to be much used in Germany.

(4) Beaumont, or Texas, oil. (See p. 20 for method of application.)

Some hogs, belonging to Mr. Vern Godden, of Greenwood, Nebr., were recently observed by the writer to be in poor condition and covered with grayish scales. Examination gave a diagnosis of sarcoptic infection in a severe form. The animals, without any previous washing or preparation, were dipped in the Beaumont oil. They were driven into the dip and scrubbed with an old broom. Special care was taken to rub the inside of the ears with the hands, since the skin on those parts was raw and cracked, and harbored scores of the parasites. The day following this treatment the animals were more quiet, and ate their food better; this improvement was particularly noticeable in the young pigs.

FIG. 21.—Ventral view of male *Demodex folliculorum* var. *suis*. (After Csokor, 1879). ×240.

On October 6, 1904, one month after treatment, Mr. Godden wrote: "As to the condition of the hogs, they are much better since the treatment; some seem to be entirely cured of that scaly look. I would recommend the Texas oil as a good thing for scabby hogs." Failure to dip a second time according to instructions, accounts for the lack of complete success in this experiment.

FIG. 22.—Ventral view of female *Demodex folliculorum* var. *suis*. (After Csokor, 1879.). (Magnified 240 times.)

### DEMODECIC MANGE.

Csokor (1879) first found the Demodex in pigs, and, on account of its resemblance in shape to a laurel leaf, named it *Demodex phylloides* (figs. 21, 22). The parasite, however, is sometimes grouped with the other varieties of the genus *Demodex* found on other animals into a single species *folliculorum*, and designated as *Demodex folliculorum* var. *suis*. *D. folliculorum* is said to be of rare occurrence, but this statement is doubtless incorrect and results from a failure to recognize the parasite. Government inspectors have frequently withheld hogs from the market because of a peculiar appearance of the skin which was shown to be caused by *Demodex*. Leather manufacturers state that a large percentage of beef hides received are partially ruined by the pitted condition of the skin, a condition which is produced by this parasite found on the cattle. It is generally held that *D. folliculorum* does not produce any pathologic symptoms nor perceptibly interfere with the growth of the

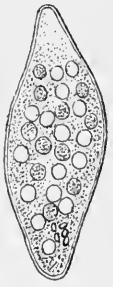

FIG. 23.—Egg of *Demodex folliculorum* var. *suis*. (After Csokor, 1879.) ×240.

animals, hence it seems to be of direct economic importance to leather manufacturers only.

The female (fig. 22) is 0.25 mm. long, elongate, with eight pairs of three-jointed legs, each provided with two claws. In front is a short median rostrum. The abdomen is tapering, transversely striate above and below, and rounded at the extremity. The vulva is situated in the anterior portion of the ventral surface of the abdomen, in front of the anus. The egg (fig. 23) is fusiform and hatches a larval hexapod, which moults three times before arriving at maturity.

The male (fig. 21) is distinguished from the female by the presence of a genital armature in front of the anus, and it is a little smaller in size.

*Demodex folliculorum* bores into the hair follicles and sebaceous glands, causing pustules that enlarge, rupture, and leave sores and ulcers on the skin. This disease spreads from the snout, over the neck, the under part of the chest and abdomen, and over the flanks and inner part of the legs. Its deep location in the skin protects the parasite from ordinary treatment.

## APPLICATION OF REMEDIES.

In applying liquid insecticides to hogs, spraying and dipping are the two methods generally used. Where there are only a few animals, the remedy can be easily applied with a brush or broom, but in a large herd a more rapid method of application is desirable.

### DIPPING.

Dipping the hogs is obviously the most thorough method, but more expensive on account of the labor and material necessary to construct a dipping vat, unless a large number are to be treated. Peters (1902) describes and gives the following instructions for constructing a dipping vat costing about $25:

12 feet 4-by-6-inch white pine or tank lumber.
40 feet 4-by-4-inch.
16 feet 2-by-6-inch.
16 feet 2-by-4-inch.
24 feet 4-by-4-inch.
24 feet 3-by-4-inch.

For the approaches and dripping platform:

10 feet 2-by-12-inch tank lumber.
100 feet 4-by-4-inch yellow pine.
60 feet 2-by-6-inch.
114 feet 2-by-4-inch.
162 feet fencing.
17 pounds 20-penny nails.
7 pounds 10-penny nails.
10 square feet of zinc.
4 "T" hinges, 8 inches.

The accompanying illustration (fig. 24) gives plans for constructing the vat. The zinc is used to cover the incline leading to the vat, in order that the smooth surface afforded will prevent the animals from halting after once starting for the plunge. The zinc covering is, of course, not a necessity, but it is very convenient. The vat is placed in an excavation in the ground, and should project about 6 inches above the surface of the ground, in order to prevent dirt and trash from falling into the dip.

Most farmers and stock raisers usually have a quantity of waste or unused lumber lying about that may be utilized in constructing a dipping plant, thus diminishing the actual cost of construction. A canvas curtain hung at the entrance to the slide will facilitate driving the hogs.

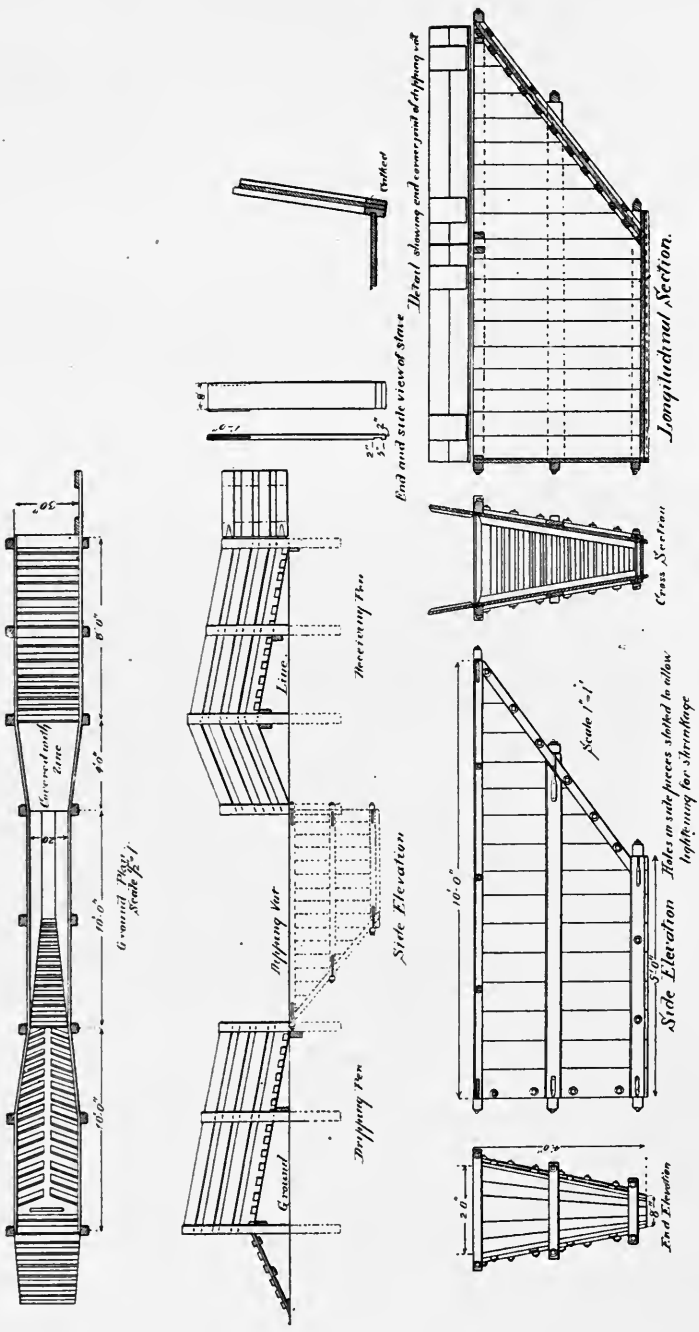


FIG. 24.—Plans for dipping tank.

The dripping platform is constructed of tongued-and-grooved lumber, slants toward the vat, and is bordered with narrow strips along the sides, in order to direct the liquid back into the vat. The platform is cleated as shown in the cut. The dipping vat should be placed in close proximity to the pens, and where a stationary chute is not built, movable panels of fence will make transferring the hogs an easy matter.

Lewis (1902), of the Oklahoma Experiment Station, constructed a galvanized-iron 22-gage vat, in which one-half inch gas pipe was used as a framework. The entire cost of such a vat, with inclined entrance and exit, is between $25 and $30.

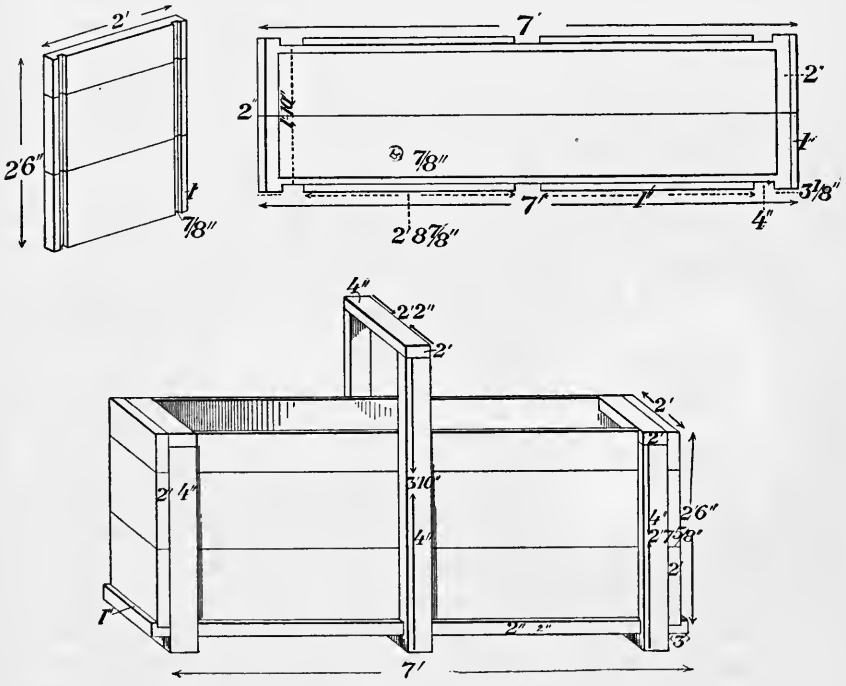


FIG. 25.—Plans for dipping tank.

There are several makes of dipping tanks offered on the market, any one of which will give satisfactory results. Galvanized and cast iron tanks of various sizes cost from $10 to $20.

A simply constructed portable dipping vat (fig. 25), used by the writer for some experiments in treating lousy and scabby hogs, is very serviceable for dipping moderate-sized herds of hogs and is also inexpensive. No dripping platform was used, consequently considerable liquid was wasted. Where there are more than 40 or 50 hogs to be dipped it is necessary to provide a dipping platform or else replenish the liquid.

The following materials are required to construct this vat:

Two 1 by 12 inch by 14 foot hard pine.
One 2 by 12 inch by 24 foot hard pine.
Three 2 by 4 inch by 12 foot hard pine.
One 1 by 6 inch by 15 foot hard pine.
One 2 by 6 inch by 12 foot hard pine.
Two pounds 20-penny nails.
Two pounds 10-penny nails.

The 2-inch planks are used for the bottom and ends of the tank, the 1-inch boards for the sides, and the 2-by-4 sticks for braces. When matched lumber is not available, the boards are joined at the edges as perfectly as possible, the cracks smeared with pitch, and calked. The boards for the sides of the tank are cut 6 feet 6¾ inches long, clamped together (after the edges have been smeared with pitch and dowel pins adjusted), and the proper braces (2 feet 7⅝ inches long) nailed on each end one-half inch from the end, with the braces projecting below the lower edge of the side, as shown in the cut. The middle brace is now nailed on in the position relative to the notch in the bottom made to receive it. The end boards are similarly joined and held together by temporary braces tacked on the outer side.

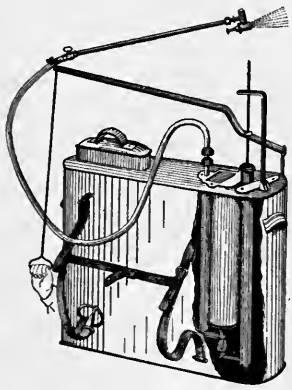

FIG. 26.—Simple spraying apparatus.

The two boards for the bottom are joined, and the braces, cut just long enough to extend between the inner margins of the notches made to receive the side braces, are nailed in place. The sides are then set in the grooves in the bottom (using pitch in the joint), forced firmly into position, and the side braces nailed to the bottom and to the ends of the braces on the bottom. The ends are next firmly fitted in the grooves in the bottom, nailed from the under side with 20-penny nails, and then nailed to the sides and side braces. The braces across the top are then nailed on.

Three pieces of 2 by 6 plank 2¾ feet long, held together by cleats nailed across them, serve as a ladder for the pigs to crawl out on. The upper end is movable so that it may be raised from position in order to keep the pigs in the dip as long as desired. The lower end of the ladder is supported 6 inches above the floor of the tank and is anchored down with a cord tied to a staple driven into the bottom of the tank. The upper end rests on the brace across the top and is held from slipping down by means of a cleat nailed on the under side. The inside measurements of the vat when completed are 6 feet 6 inches long, 1 foot 8 inches wide, 2 feet 5 inches deep, and holds 6¾ gallons of fluid to an inch of depth. Twenty inches of fluid is sufficient to cover a

300-pound hog. When using this vat it is of course necessary to increase the height of the sides by a temporary construction and to construct a chute leading to the vat. The vat should be sunk into the ground a depth of 2 feet, thus saving the trouble of having to force the pigs up an inclined plane. It is most convenient to set the vat in front of a door to a hog house, sink it into the ground till the top is level with or a little below the floor of the house, and then build a barricade from the door along the sides of the vat.

### SPRAYING.

When the necessary apparatus is provided, dipping the hogs is the most convenient and rapid method of applying insecticides. Experi-

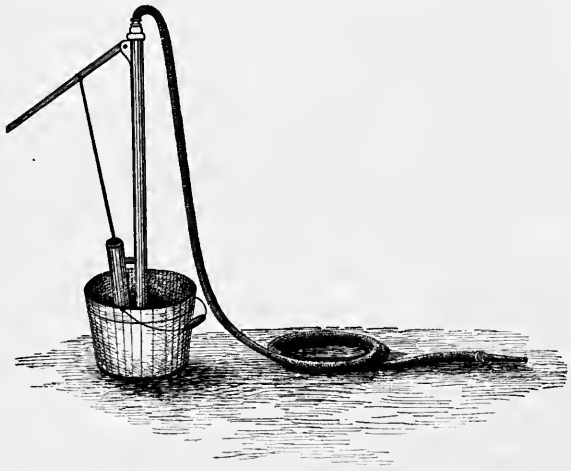

FIG. 27.—Simple spraying apparatus.

ments, however, have proved that spraying liquids over animals is equally effective if thoroughly performed. A force pump is fitted with a hose of sufficient length to permit freedom of motion to the operator. A spray nozzle is attached to the end of the hose, or, as has

FIG. 28.—Simple spraying apparatus.

been done in the absence of a suitable nozzle, the end of the hose is simply compressed between the thumb and forefinger, making a fan-like spray that can be readily directed in any quarter. Any outfit for spraying trees is likely to contain nozzles that can be adapted to spraying liquids over animals. For those who do not possess a spraying

apparatus, and do not care to purchase the more expensive outfits, one of the cheaper pumps put out by firms handling such goods will serve the purpose very well.

The illustrations of spraying outfits given (figs. 26–28) represent the character of some of the less expensive ones offered for sale. There should be considerable force to the jet of fluid, and the spray must not be too finely divided, otherwise the liquid will not penetrate between the hair and thoroughly wet the skin, as it must do to be effective.

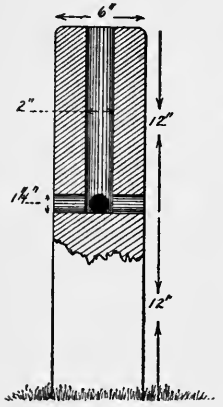


FIG. 29.—Sectional view of post with holes bored from top and sides.

A method of applying kerosene to hogs that is as simple as it is ingenious was employed by Moore (1891) and Riedel (1891). A 6 by 6 inch oak post is set firmly in the ground (fig. 29). A 2-inch hole is bored 12 inches into the top of the post. A 1¼-inch hole is bored from each side of the post to open into the bottom of the larger hole. Soft-pine plugs are driven into the small holes and burlap or old cloth is wrapped around the post, covering the pine plugs, and bound down with wire. The hole in the top of the post is then filled with kerosene. In a short time the rags become saturated with the kerosene percolating through the pine plugs. Two quarts of oil daily are required the first three or four days and afterwards 1 quart a week. Riedel remarks that "every hog wanted to be first at the post," and that the lice in the herd soon disappeared. A platform should be built around the post in order that the hogs will not dig a mud wallow about its base.

Byrn (1890) devised a "wholesale method of ridding a herd of lice" by digging a basin, or wallow, in the yard, pouring in water and throwing in a small quantity of kerosene. He states that the pigs frequented this place and the lice soon disappeared.

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